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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,864	04/18/2005	William Charles Maskell	330-024	4084

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EXAMINER	
DINH, BACH T	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/18/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/531,864	MASKELL ET AL.	
	Examiner	Art Unit	
	BACH T. DINH	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 August 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *43-53 and 68-74* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *43-53 and 68-74* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Summary

1. This is the response to the communication filed on 08/14/2009.

2. Claims 43-53 and 68-74 remain pending in the application.

3. The application is not in condition for allowance.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 50 recites the limitation "the 4-valent metal oxide" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 43-53, 68, 71 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 4,880,519) in view of Tuchinskiy (US 5,774,779) with further evidence provided by Keefer et al. (US 4,587,224), Rokutanzono et al. (US 2001/0016296) and Vaidyanathan (US 7,360,390). Wang is recited and relied on for the first time in this office action. Its use is necessitated by Applicant's amendment to the claims.

Addressing claims 43 and 48-52, Wang discloses a method of forming an oxygen sensor (Abstract, figures 1-2) that includes an internal cavity 21 and a diffusion hole 31, the diffusion hole providing a passageway between the internal cavity 21 and outside of the sensor, the method comprising:

Forming a green ceramic structure from an intimate mixture of a powder of ceramic and a binder (green ceramic layers 11-17 of yttria stabilized zirconia are made by mixing stabilized zirconia powder with a binder; 3:1-20), the stabilized zirconia is the oxygen ion conductor and the walls of the ceramic layers define the internal cavity 21;

Incorporating plastic wire or other filamentary material into the structure (3:65-4:1) so that the filamentary material extends from the internal cavity 21 to a said wall of the ceramic structure to the outside of the sensor (figure 1, the diffusion hole 31 extends from the internal cavity 21 to the outside; therefore, the filamentary material extends in the same manner) in a straight path;

Positioning a porous electrode 25 on a surface of the oxygen ion conductor (electrode 25 is positioned on the surface of layer 11) that faces the cavity, the arrangement being such that the oxygen ion conductor forms an electrolyte of a sensor

element (the layer 11 is made of stabilized zirconia which is the electrolyte of the sensor 10) when sandwiched between the porous electrode 25 and a second electrode 26 (in the alternative, the electrode 25 is also positioned on the electrolyte layer 12, which is sandwiched between the electrode 25 and 26; the electrolyte layer 12 is also the electrolyte of the sensor 10); and

Firing the green ceramic structure at an elevate temperature to cure the ceramic (4:10-28, the laminated ceramic is sintered at elevated temperature) and to destroy the binder and the filamentary material (4:10-13, the filamentary material is burnt away; furthermore, the binder would also be burnt away at the elevated temperature), thereby providing the sensor with a diffusion hole that forms a passageway 31 between the internal cavity and outside of the sensor.

Wang is silent regarding the filamentary materials are organic fibre or other organic element.

Tuchinskiy discloses a method of forming channels in green sheet of zirconia ceramic material (10:18-28). The channels are formed by incorporating organic material (6:31-36) into rods of green zirconia ceramic material. The green ceramic rods are fired at elevated temperature to burn away the organic material; thereby, forming the channels (10:43-50).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the method of Wang with the organic filler material of Tuchinskiy for forming the diffusion hole because both Wang and Tuchinskiy disclose forming channels within ceramic material buy burning off materials at elevated temperatures. Therefore,

one would have obtained the predictable results of forming the diffusion hole 31 of Wang by using the known organic material for forming channel in ceramic structure of Tuchinskiy for the known method of forming diffusion hole in a gas sensor by burning off filamentary material at elevated temperature as disclosed by Wang (KSR, rationale B, MPEP 2141).

Addressing claim 44, Wang discloses the binder material is polyvinyl butyral (3:8), which is water soluble according to the evidence provided by Rokutanzono [0191]. Tuchinskiy discloses the binder for forming the stabilized zirconia ceramic material is ethylene vinyl acetate or ethylene ethyl acetate (6:26-29), which is also water-soluble polymer according to the evidence provided by Vaidyanathan (7:33-36).

Addressing claims 45-46, Wang discloses the diameter of the diffusion hole 31 is 0.0015 (4:25-28), which is 38.1 microns.

Addressing claim 47, the green ceramic layers are fired at temperature ranging from 400 to 1500 ^{o}C (4:17-20).

Addressing claim 53, Wang discloses the green ceramic material is sintered at 1500 ^{o}C (4:19), which will form tetragonal or cubic crystalline of zirconia as shown with the evidence provided by Keefer (Abstract, tetragonal phase of zirconia is obtained at temperature from 800-1200 ^{o}C).

Addressing claim 68, figures 2-3 of Tuchinskiy show that the filler organic material has a uniform or non-uniform cross-section.

Addressing claim 71, Wang discloses the porous electrodes are made of platinum (3:27-40).

Addressing claim 74, Wang discloses the material that forms the diffusion hole 31 as filamentary (3:65-67), which reads on the diffusion hole forming material is a fibre. Tuchinskiy discloses the organic filler has elongated shape in order to form the channel through the ceramic structure (figure 4); therefore, the elongated shape of the organic filler material reads on the claimed organic fibre.

9. Claims 69-70 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 4,880,519) in view of Tuchinskiy (US 5,774,779) as applied to claims 43-53, 68, 71 and 74 above, and further in view of Noda et al. (US 4,770,760). Noda is cited and relied on for the first time in this office action. Its use is necessitated by Applicant's amendment to the claims.

Addressing claims 69-70 and 73, Wang discloses the structure is formed on stabilized zirconia, as discussed above, which is an oxygen ion-conducting ceramic with the diffusion hole formed through an end or side of the cylindrical structure (figures 1-2). Wang is silent regarding the gas sensor is cylindrical.

Noda discloses a gas sensor; wherein, the solid electrolyte body 12 (figures 1-2) can be planar or tubular in shape (11:1-8).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the solid electrolyte layer of Wang to have a tubular or cylindrical configuration because Noda shows that the shape of the solid electrolyte could be changed in order to accommodate specific requirements of the sensor (Noda, 11:1-8). Furthermore, such obvious change in shape does not change the fundamental function of the gas sensor.

Regarding the subject matter of claim 70, a tubular solid electrolyte structure would have a circular cross-section.

10. Claim 72 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 4,880,519) in view of Tuchinskiy (US 5,774,779) as applied to claims 43-53, 68, 71 and 74 above, and further in view of Friese (US 5,374,390). Friese is cited and relied on for the first time in this office action. Its use is necessitated by Applicant's amendment to the claims.

Addressing claim 72, Wang discloses the porous electrode is made of platinum.

Wang is silent regarding the porous electrode comprises oxygen-ion-conductor cermet that is of the same composition as the green ceramic.

Friese discloses electrodes for gas sensors; wherein, the electrode comprises platinum and stabilized zirconia (3:3-15).

At the time of the invention, one with ordinary skill the art would have found it obvious to modify the porous electrode of Wang by incorporating the stabilized zirconia cermet

material of the solid electrolyte with platinum material as disclosed by Friese because doing so would improve the mechanical properties and high load carrying capacity of the electrodes (Friese, 2:7-10).

11. Claims 43-53, 68, 71 and 74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 5,217,588 or '588) in view of Wang et al. (US 4,880,519 or '519) and Tuchinskiy (5,774,779) with further evidence provided by Keefer et al. (US 4,587,224), Rokutanzono et al. (US 2001/0016296) and Vaidyanathan (US 7,360,390). Wang '588 is cited and relied on for the first time in this office action. Its use is necessitated by Applicant's amendment to the claims.

Addressing claims 43 and 48-52, Wang '588 discloses a method of forming an oxygen sensor (figure 3; 1:54-65, oxygen activities are determined by the sensor) that includes an internal cavity 31 and a diffusion hole 33, the method comprising:

Forming yttria-stabilized zirconia ceramic body 30 comprises a plurality of walls that together define the internal cavity (figure 3);

The diffusion hole extends from the internal cavity 31 to the outside in a straight path (figure 3);

The porous electrode 35 faces the internal cavity and the portion of the body 30 that is sandwiched between the electrodes 35 and 36 is the electrolyte of the sensor element.

Wang '588 further discloses the sensor in figure 3 is produced using the method recited in Wang '519 (4:11-23).

Wang '588 is silent regarding the step of forming the a green ceramic structure from an intimate mixture of a powder of the ceramic and a binder, incorporating at least one organic fibre or other organic element to the ceramic structure for forming the diffusion hole and firing the green ceramic structure at elevated temperature to cure the ceramic and to destroy the binder and the organic fibre or other organic element.

Wang '519 discloses a method of forming a gas sensor; wherein, the solid electrolyte body of the sensor is formed from green sheet of yttria stabilized zirconia powder and binder (3:1-20). The diffusion hole 31 is formed by burning off filamentary material at elevated temperature (4:10-13) and the green ceramic structure is cured at elevated temperature to destroy the binder and the filamentary material (4:10-28).

Tuchinskiy discloses a method of forming channels in green sheet of zirconia ceramic material (10:18-28). The channels are formed by incorporating organic material (6:31-36) into rods of green zirconia ceramic material. The green ceramic rods are fired at elevated temperature to burn away the organic material; thereby, forming the channels (10:43-50).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the method of Wang '588 with the method of forming the gas sensor as disclosed by Wang '519 because Wang '588 explicitly discloses that the gas sensor of figure 3 is made by the method of Wang '519. Furthermore, one with ordinary skill in the art would have found it obvious to modify the method of forming the diffusion hole of Wang '519 with the organic filler material of Tuchinskiy for forming the diffusion hole because both Wang '519 and Tuchinskiy disclose forming channels within ceramic

material buy burning off materials at elevated temperatures. Therefore, one would have obtained the predictable results of forming the diffusion hole 33 of Wang '588 and '519 by using the known organic material for forming channel in ceramic structure of Tuchinskiy for the known method of forming diffusion hole in a gas sensor by burning off filamentary material at elevated temperature as disclosed by Wang '519 (KSR, rationale B, MPEP 2141).

Addressing claim 44, Wang '519 discloses the binder material is polyvinyl butyral (3:8), which is water soluble according to the evidence provided by Rokutanzono [0191]. Tuchinskiy discloses the binder for forming the stabilized zirconia ceramic material is ethylene vinyl acetate or ethylene ethyl acetate (6:26-29), which is also water-soluble polymer according to the evidence provided by Vaidyanathan (7:33-36).

Addressing claims 45-46, Wang '588 discloses the size of the diffusion hole 33 is 50 microns. Wang '588 is silent regarding the recited size is diameter or radius; however, if the size recited by Wang '588 is indeed the radius, the diameter would be 100, which falls within the claimed range. Therefore, it is Examiner's position that the size of the diffusion hole recited by Wang '588 falls within the claimed range of the diameter of the diffusion hole.

Wang '519 discloses the diameter of the orifice 31 is .0015 inch, which is 38.1 microns. In the alternative, at the time of the invention, one with ordinary skill in the art would have found it obvious to modify the diameter of the diffusion hole 33 of Wang '588 to be

38.1 microns as disclosed by Wang '519 because the diffusion hole of Wang '519 with the recited diameter is still capable of providing gaseous communication between the internal cavity and the outside. Furthermore, the diameter of the diffusion hole affects the amount of gas that enters the internal cavity; therefore, one would have arrived at the claimed range of diameter when performing routine experiments to optimize the diffusion of the gas to the internal cavity of the sensor.

Addressing claim 47, Wang '519 discloses the green ceramic layers are fired at temperature ranging from 400 to 1500 ^{o}C (4:17-20).

Addressing claim 53, Wang '519 discloses the green ceramic material is sintered at 1500 ^{o}C (4:19), which will form tetragonal or cubic crystalline of zirconia as shown with the evidence provided by Keefer (Abstract, tetragonal phase of zirconia is obtained at temperature from 800-1200 ^{o}C).

Addressing claim 68, figures 2-3 of Tuchinskiy show that the filler organic material has a uniform or non-uniform cross-section.

Addressing claim 71, Wang '588 discloses the porous electrodes are made of platinum (4:21-22).

Wang '519 discloses the porous electrodes are made of platinum (3:27-40).

Addressing claim 74, Wang discloses the material that forms the diffusion hole 31 as filamentary (3:65-67), which reads on the diffusion hole forming material is a fibre.

Tuchinskiy discloses the organic filler has elongated shape in order to form the channel through the ceramic structure (figure 4); therefore, the elongated shape of the organic filler material reads on the claimed organic fibre.

12. Claims 69-70 and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 5,217,588 or '588) in view of Wang et al. (US 4,880,519 or '519) and Tuchinskiy (5,774,779) as applied to claims 43-53, 68, 71 and 74 above, and further in view of Noda et al. (US 4,770,760).

Addressing claims 69-70 and 73, Wang '588 and '519 disclose the structure is formed on stabilized zirconia, as discussed above, which is an oxygen ion-conducting ceramic with the diffusion hole formed through an end or side of the cylindrical structure (figures 1-2).

Wang '588 and '519 are silent regarding the gas sensor is cylindrical.

Noda discloses a gas sensor; wherein, the solid electrolyte body 12 (figures 1-2) can be planar or tubular in shape (11:1-8).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the solid electrolyte layer of Wang '588 to have a tubular or cylindrical configuration because Noda shows that the shape of the solid electrolyte could be changed in order to accommodate specific requirements of the sensor (Noda, 11:1-8). Furthermore, such obvious change in shape does not change the fundamental function of the gas sensor.

Regarding the subject matter of claim 70, a tubular solid electrolyte structure would have a circular cross-section.

13. Claim 72 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (US 5,217,588 or '588) in view of Wang et al. (US 4,880,519 or '519) and Tuchinskiy (5,774,779) as applied to claims 43-53, 68, 71 and 74 above, and further in view of Friese (US 5,374,390).

Addressing claim 72, Wang '588 and '519 disclose the porous electrode is made of platinum, as discussed above.

Wang '588 and '519 are silent regarding the porous electrode comprises oxygen-ion-conductor cermet that is of the same composition as the green ceramic.

Friese discloses electrodes for gas sensors; wherein, the electrode comprises platinum and stabilized zirconia (3:3-15).

At the time of the invention, one with ordinary skill the art would have found it obvious to modify the porous electrode of Wang '588 by incorporating the stabilized zirconia cermet material of the solid electrolyte with platinum material as disclosed by Friese because doing so would improve the mechanical properties and high load carrying capacity of the electrodes (Friese, 2:7-10).

Response to Arguments

14. Applicant's arguments with respect to claims 43-53 and 68-74 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BACH T. DINH whose telephone number is (571)270-5118. The examiner can normally be reached on Monday-Friday EST 7:00 A.M-3:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/
Supervisory Patent Examiner, Art Unit 1753

BD
12/17/2009